CLAIMS

1. A method of detecting a predetermined alarm condition in a combustion emission gas, the method comprising exposing to the gas a semiconductor gas sensor having a p-type semiconducting material, the semiconducting material being responsive both to a change in concentration of a reducing gas in the surrounding atmosphere and to a change in concentration of oxygen in the surrounding atmosphere to exhibit a change in its electrical resistance; monitoring the resistance; and outputting an alarm signal if the resistance exceeds a predetermined value corresponding to the alarm condition.

2. A method according to claim 1, wherein the reducing gas is one of CO, H_2, CH_4 and higher hydrocarbons.

3. A method according to claim 1 or claim 2, wherein the electrical resistance of the semiconductor gas sensor is related to the concentrations of oxygen and carbon monoxide in the surrounding atmosphere over at least a range of atmospheric compositions via an expression of the form:

$$R_G = A[O_2]^{-1/x} + B[O_2]^{-1/x}[CO]^{1/2}$$

where :

R_G is the observed sensor resistance

$[O_2]$ is the oxygen concentration

[CO] is the carbon monoxide concentration

A, B are constants which depend on the sensor resistance under reference conditions

x is a parameter which depends on the point defect chemistry of the oxide system.

4. A method according to any of the preceding claims, wherein the p-type material comprises a metal oxide.

5. A method according to any of claims 1 to 3, wherein the p-type material comprises a mixed metal oxide.

6. A method according to claim 4 or claim 5, wherein the metal is of the first, second and/or third order transition metal series.

7. A method according to claim 6, wherein the semiconductor material comprises a p-type oxide of the Cr-Ti-O system.

8. A method according to claim 6, wherein the semiconductor material comprises a p-type Cr-Ti-Mn-O system, CuO with TiO_2 or CoO with TiO_2.

9. A method according to any of the preceding claims, wherein the combustion emission gas is a flue gas.

10. A combustion emission gas alarm system comprising a semiconductor gas sensor having a p-type semiconducting material, the semiconducting material being responsive both to a change in concentration of a reducing gas in the surrounding atmosphere and to a change in concentration of oxygen in the surrounding atmosphere to exhibit a change in its electrical resistance; and apparatus for monitoring the resistance of the semiconducting material and for issuing an alarm signal if the resistance exceeds a predetermined value corresponding to an alarm condition.

11. A system according to claim 10, wherein the electrical resistance of the semiconductor gas sensor is related to the concentrations of oxygen and carbon monoxide in the surrounding atmosphere over at least a range of atmospheric compositions via an expression of the form:

$$R_G = A[O_2]^{-1/x} + B[O_2]^{-1/x}[CO]^{1/2}$$

where :

R_G is the observed sensor resistance

$[O_2]$ is the oxygen concentration

[CO] is the carbon monoxide concentration

A, B are constants which depend on the sensor resistance under reference conditions

x is a parameter which depends on the point defect chemistry of the oxide system.

12. A system according to claim 10 or claim 11, wherein the p-type material comprises a metal oxide.

13. A system according to claim 10 or claim 11, wherein the p-type material comprises a mixed metal oxide.

14. A system according to claim 12 or claim 13, wherein the metal is of the first, second and/or third order transition metal series.

15. A system according to claim 13 or claim 14, wherein the semiconductor material comprises a p-type oxide of the Cr-Ti-O system.

16. A system according to claim 13 or claim 14, wherein the semiconductor material comprises a p-type CuO with TiO_2 or CoO with TiO_2.

17. A system according to any of claims 10 to 16 mounted to or adjacent to a flue gas outlet so as to expose the sensor to a gas flue.